

# Underground Cable Fault Detection Using Matlab

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**ABSTRACT:**In smart cities, underground cables will be used because it has many advantages such as immunity from weather, rainfall, thunderstorm, etc. But it is difficult to detect fault in underground cable. The objective of this project is to detect exact fault location in an underground cable. A set of resistors represents the resistance of cable. When any fault occurs the voltage and current vary which depends on the distance of fault from base substation. The controller will measure and monitor the voltage and current of the cable using analog to digital converter. The exact location of fault will be decided based on changes in voltage and current of cable. This location will be indicated on display. The detection of fault of cable will be simulated using MATLAB software. The identical performance of controller will be represented using PROTEUS software.

**KEYWORDS:**Underground Cable, Fault Detection, Fault Location, LCD Display.

## I. INTRODUCTION

The power delivering to consumer should be with less losses and safe medium. Overhead transmission lines are being used in current power system which is not much reliable or safe so to overcome its problem underground cables are used. To detect the fault in underground cable various methods are used. While faults can occur for different reason in cable line, the repairing process related to that particular cable is difficult due to not knowing the exact location of cable fault. As it is very difficult to find the exact location or faulty location manually, which suddenly affects the efficiency of the cable wire due to losses occurred. Nowadays many techniques had already been implemented in order to detect cable line fault [1].

Types of faults

### 1) Open-circuit fault

A break in the conductor is called open-circuit fault. This type of fault is caused by break in conducting path such faults occurs when one or more phase conductors break.

### 2) Short-circuit fault

When an insulator fails, it is due to the 2 conductors of a multi-core cable coming in contact with each other electrically, which indicates short-circuit failure. It can be divided in two types:

#### a) Symmetrical fault

Three-phase fault is called symmetrical fault. In these all three phases are short circuited.

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b) Unsymmetrical fault

In this fault magnitude of current is not equal & not displaced by 120 degree.

### 3) Earth fault

When the conductor of a cable comes in contact with earth, it is called earth fault or ground fault. To identify this fault, one terminal of the megger is connected to the conductor and the other terminal connected to the earth. If the megger indicates zero reading, it means the conductor is earthed. The same procedure is repeated for other conductors of the cable [2].

### Causes of cable faults

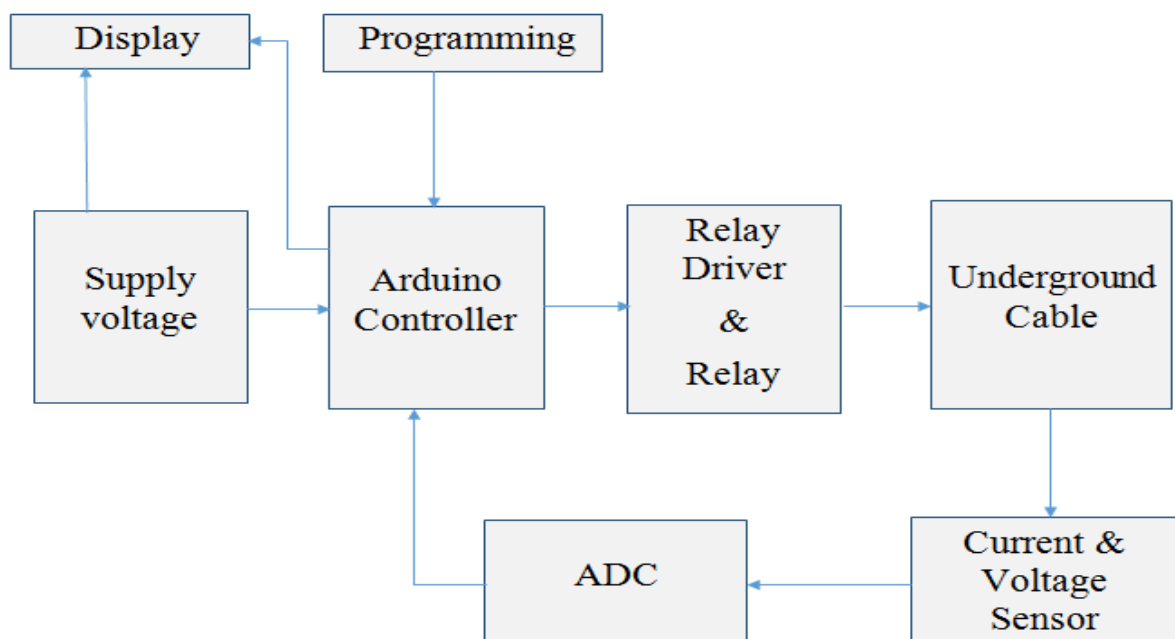
Faults in cables are mostly caused by dampness in the paper insulation of cables. As a result, it can damage the lead sheath which protecting the cable. Lead sheath can be damaged in many ways. Most of them are the chemical reaction of soil on the lead when buried underground [3].

Types of test to locate fault

- 1) Murray Loop Test
- 2) Varley Loop Test

The only difference between Murray loop and Varley loop is that this loop provision is made for measurement of total loop resistance instead obtaining it from the relation.

## II. BLOCK DIAGRAM



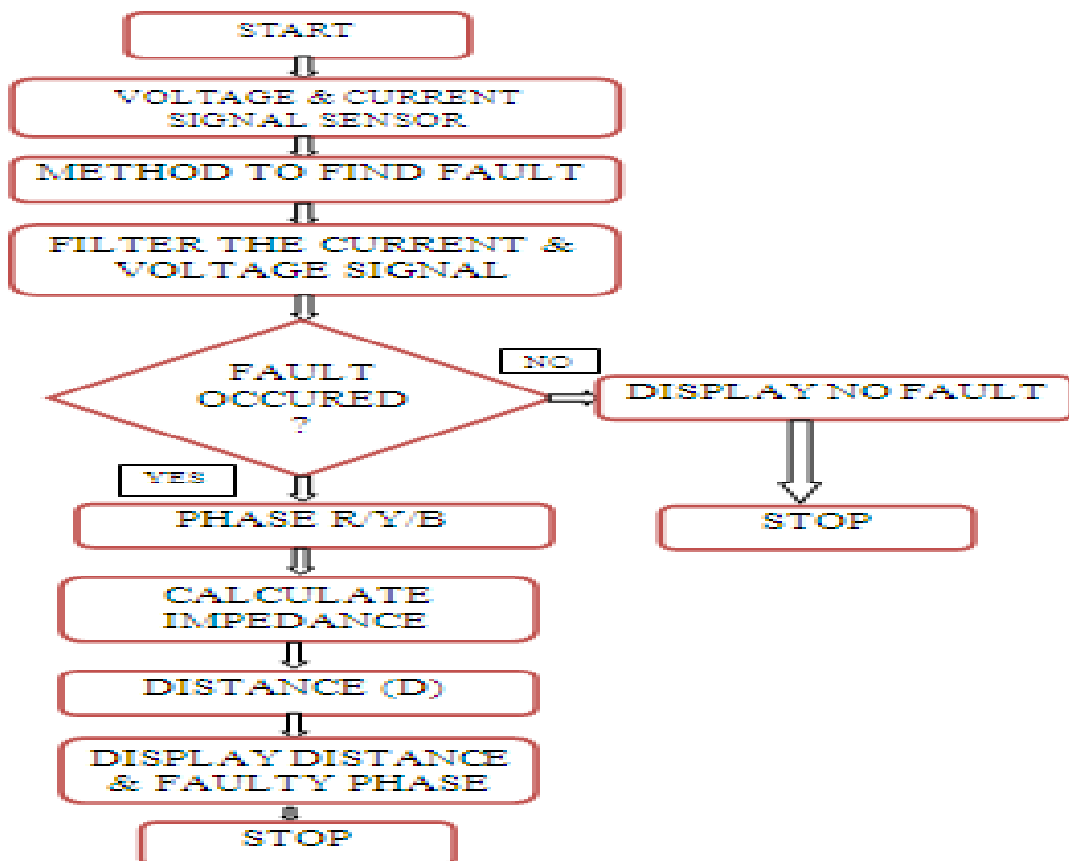
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## III. FLOW CHART



## IV. SIMULATION MODEL

### 1) Simulation Parameters

Sr no.	Parameter	Value
1	Length of the cable	100 Km
2	Line Voltage	220 KV
3	Frequency	50 Hz
4	Resistance per unit length	0.012 $\Omega$
5	Inductance per unit length	0.9 mH
6	Capacitance per unit length	127 $\mu$ F
7	Internal resistance of source	0.90 $\Omega$
8	Internal inductance of source	0.16 mH
9	Active Power	10 KW
10	Inductive Reactive Power	100 VAR
11	Capacitive Reactive Power	100 VAR

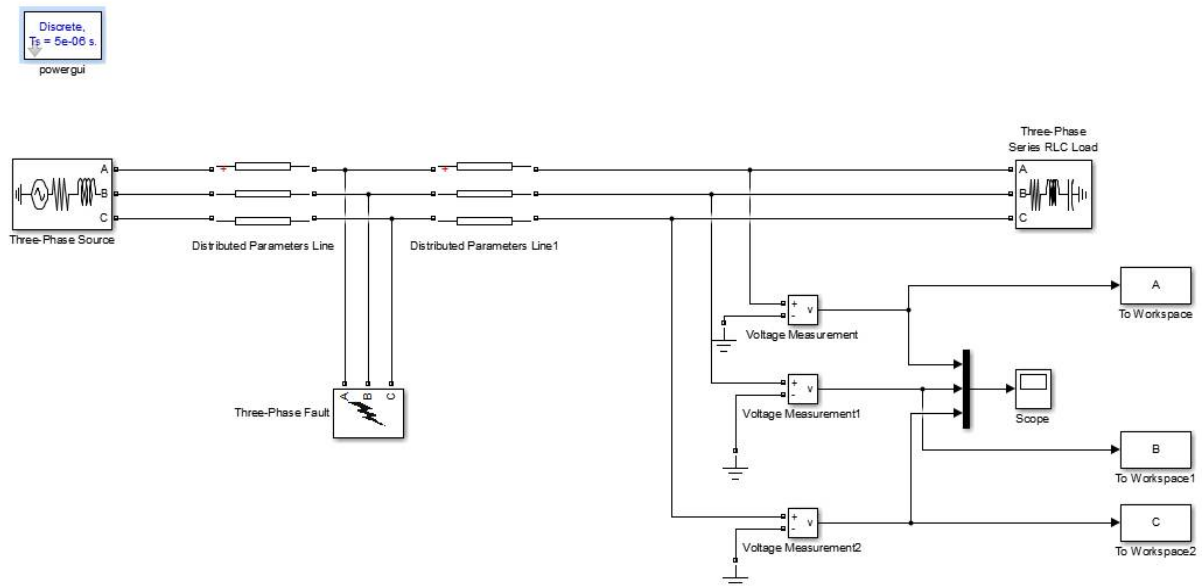
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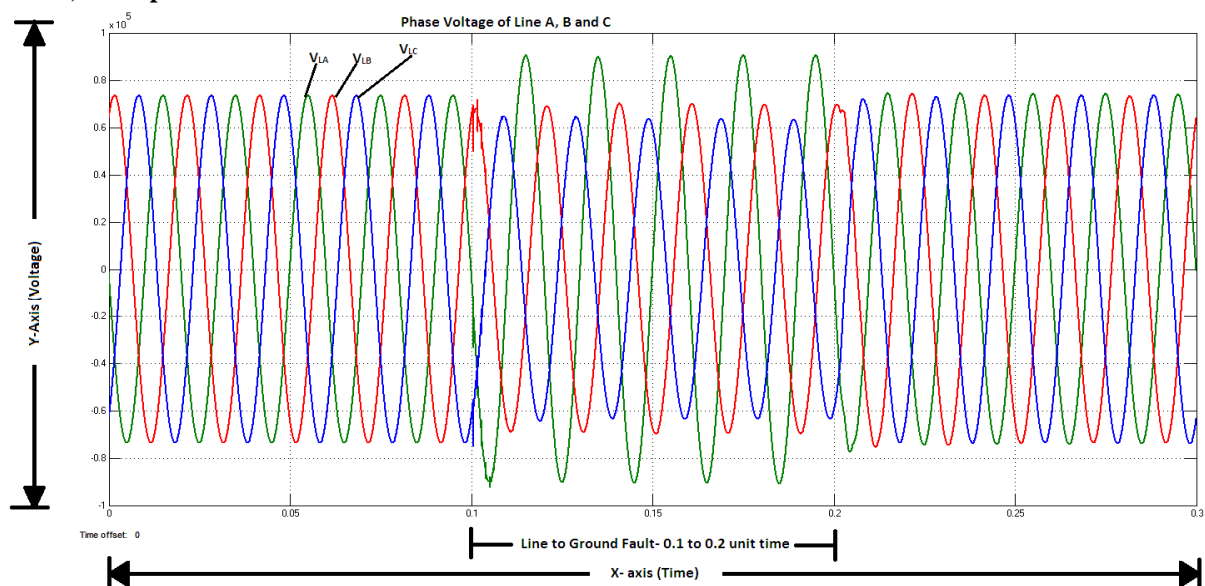
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## 2) Simulink Model



We have one three phase source and the transmission line is given. We created fault in transmission line. We measure the magnitude of the voltage in healthy condition & after faulty condition.

## 3) Output Waveform



The transmission line model system was simulated to identify the type of fault on the affected phase. The system was designed with a means of observing all the phases on the transmission line on one platform, using the scope in MATLAB/SIMULINK. In a double phase fault, two of the signals with faults indicated some deviations from the expected wave form. When the type of the fault had been established, fault data, which can be referred to as signal from

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the line was analyzed under wavelet transform to extract useful information pertaining to the fault. The development of the transmission line was done under MATLAB/SIMULINK environment. The line considered is a 100km, 220KV, 50Hz underground power cable. The system analyzed post fault conditions and all the simulations done were to generate fault signals to be used to identify and locate the faults and generate a database for later use. The fault is created after every 5km distance, with a simulation time of 0.001s, sample time = 0, resistance per unit length = 0.012Ω, inductance per unit length = 0.9 mH and capacitance per unit length = 127μF. The system considers a constant load and the phase angle is also varied between -120° to 120°, with the increasing step of 30°, phase A being the reference. Phase angle was used because it was indicating some variations on the fault location when initial simulations were carried out [4].

## V. ADVANTAGES

- Maintenance is very less and higher efficiency.
- The system is more compact.
- Lower weather restoration cost.
- Fire resistant.
- Compact size, Easy to handle.
- Provides precise accuracy in determining the location of fault.

## VI. APPLICATION

Its main application is the detection of underground cable fault which is very hard to detect as it is not possible to see faults like line to line and other such faults which are quite possible in the case of overhead transmission line. So for such cases our project is very helpful as the distance at which the fault has occurred can be calculated and then further action regarding the fault can be taken to overcome them [5].

## VII. CONCLUSION

During this project we learned different methods to find fault in Underground cable. We also performed simulation on MATLAB. We were able to identify the fault in transmission line by observing the waveform.

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